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**UNITED STATES DISTRICT COURT**

**SOUTHERN DISTRICT OF CALIFORNIA**

JESUS ROMERO, a Minor, by and through his Guardian ad Litem, MERIDA RAMOS; MARCOS ROMERO, a Minor, by and through his Guardian ad Litem, MERIDA RAMOS; and PERLA ROMERO, a Minor, by and through her Guardian ad Litem, MERIDA RAMOS,

Plaintiffs,

v.

MACY'S, INC., fka FEDERATED DEPARTMENT STORES, INC., a Delaware corporation; RALPH LAUREN CORPORATION, a Delaware corporation; and DOES 1 through 50, Inclusive,

Defendants.

Case No.: 3:15-cv-00815-GPC-MDD

**DECLARATION OF DAVID HALL, Ph.D, P.E., F.T.I., F.S.D.C., IN SUPPORT OF PLAINTIFFS JESUS ROMERO, ET AL.'S OPPOSITION TO DEFENDANTS MACY'S INC., ET AL.'S MOTION FOR SUMMARY JUDGMENT**

**DATE:** September 23, 2016
**TIME:** 1:30 p.m.
**CTRM:** 2D

**JUDGE:** Hon. Gonzalo P. Curiel

I, David Hall, Ph.D., P.E., F.T.I., F.S.D.C, declare as follows:

1. I make this declaration in support of Plaintiffs' Opposition to Motion for Summary Judgment in the above-captioned case. I have personal knowledge of the facts set forth herein, except as to those stated on information and belief and, as to those, I am informed and believe them to be true. If called as a witness, I could and would competently testify to the matters stated herein.

2. I was Professor of Textile Engineering and Materials Engineering (joint appointment) at Auburn University until my retirement in 1995, when I became Professor Emeritus of Textile Engineering. I maintained an office in the department until 2008, and I am still afforded laboratory privileges. I had been a member of the Auburn University faculty since 1965. I received a Bachelor of Science in Textile Chemistry from Auburn University in 1958, a Master of Science in Textile Chemistry from Clemson University in 1962, and a Ph.D. in Polymer and Fiber Science from the Victoria University of Manchester England in 1964. I did post-doctoral studies at the Swiss Federal Institute (Zurich - 1965). I am a Registered Professional Engineer in Alabama. A true and correct copy of my current *curriculum vitae* is attached to Plaintiffs' Evidence in Opposition to Motion for Summary Judgment ("Plaintiffs' Evidence") as **Exhibit 10**. During the course of my career I have received numerous honors and awards. For instance, I was elected to the Tau Beta Pi under the Eminent Engineer status in 1970; I was elected a Chartered Textile Technologist and Fellow of the Textile Institute (FTI) in 1974; I have been a Chartered Colorist and Fellow of the Society of Dyers and Colorist since 1980; and I was the recipient of the R&D 100 award for Research in 1989. The Department of Fiber and Polymer Engineering designated me as their outstanding alumnus for 2007. I was also a Mobilization Designee to the Department of the Army Research and Development Command and was involved in their textile activities for over 20 years before my retirement as Colonel.

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3. My teaching duties at both the undergraduate and graduate level while at Auburn University involved all areas of Textile Chemistry including, Preparation Dyeing and Finishing, Textile Sizing, Chemical Testing Methods, Natural and Man Made Fibers as well as laundry practices for consumer textiles.

4. Over the past 35 years, I have received numerous research grants and have published the results widely in the area of textile technology, specifically in the use of Scanning Electron Microscopy and Energy Dispersive Analysis for problem solving applications. Among my publications are five textbooks on Textile preparation, Testing, Sizing (two books) and Fiber Identification. In addition I have written several chapters in other books. I have also published over 45 refereed research papers and numerous other "state-of-the-art" type papers. Further, I have presented over 75 technical/research papers to various professional organizations and gatherings in the area of textile science and technology. I have been a reviewer for several peer journals such as *Textile Research Journal* and *Industrial and Engineering Chemistry*. I hold 35 issued U.S. patents, all in the area of textile science or applied textile technology. I also have substantial experience in textile forensic. I have performed analyses and or tests for over 200 textile related firms many of which involved leading edge technology as well as standard testing methods.

5. In preparation for this declaration, I reviewed the following materials: Plaintiffs' First Amended Complaint; Defendants' Motion for Summary Judgment, Separate Statement of Undisputed Facts, Compendium of Evidence, and Declarations of of Marcelo Hirschler and Kenneth Kawabata in support thereof; photographs of the Subject Shirt and Plaintiff Jesus Romero's injuries; excerpts from Jesus Romero's medical records; the Subject Shirt; two exemplar shirts of the same Ralph Lauren style as the Subject Shirt; and the deposition transcripts of Jesus Romero, Marcos Romero, Merida Ramos, Marcelo Hirschler, and Erik Richman.

6. It is my understanding, based on review of the documents listed above, that Plaintiff Jesus Romero, age 7 at the time, was wearing a boys' short-sleeved Ralph

Lauren gingham dress shirt (the "Subject Shirt") that ignited and burned quickly when it made contact with a small flame from a lighter. Plaintiffs in this matter retained me as an expert in textiles and fabric identification and analysis. It is my opinion that the Subject Shirt's fabric was made from a blend of no more than 90% cotton, and at least 4-5% nylon and at least 5-6% rayon. A yarn-level blend of the type and complexity used to construct the Subject Shirt had to be the result of an intentional act—not a byproduct of the manufacturing process. I analyzed the fiber content in two exemplar shirts of the same Ralph Lauren style as the Subject Shirt; both were labeled 100% cotton yet they, too, included nylon and rayon fibers.

7. The fabric content of clothing is important to the safety of the wearer: ease of ignition, flammability, and potential for thermal injury all depend on the fiber type. The cotton/rayon/nylon blend used to construct the Subject Shirt was far more dangerous than 100% cotton. A blended fabric tends to adopt the worst flammability characteristics of its constituent fibers, even in small percentages. The cotton/rayon/nylon blend seen in the Subject Shirt would exhibit easy ignition, rapid flame propagation, and prolonged burning at a higher heat due to nylon, which melts and sticks to skin. The rayon in the blend would cause it to shrink in toward the wearer, bringing the flaming, molten garment nearer to the skin and increasing the depth of burns. If the Subject Shirt had been 100% cotton as labeled, it would have burned quickly, away from Jesus Romero's body, and turned to ash. Jesus's injuries would have been much less severe if he had been wearing a 100% cotton shirt.

8. Fiber identification and fiber analysis for textile content can be measured and identified through a variety of methods. The American Association of Textile Chemists and Colorists ("AATCC") provides the most widely accepted and utilized method within the scientific and engineering community. AATCC method 20-2013 and 20A-2014 are the accepted qualitative and quantitative techniques for fiber identification within the industry and within the scientific community.

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9. Examination by Scanning Electron Microscope ("SEM") should be the first step in the fiber identification process, particularly where, as here, there is a limited quantity of fabric available for testing. In fact, when sample size is so limited, SEM is the most accurate method of identifying fiber content in a blended yard. In addition, it is the most accurate method of distinguishing between cotton and rayon fibers when there is limited fabric available for testing.

10. I performed an SEM analysis on remnants of the Subject Shirt worn by Jesus Romero at the time he was badly burned. The burns suffered by Jesus did not seem to be consistent with an all-cotton shirt; the purpose of my analysis was to determine whether or not the Subject Shirt was 100% cotton as labeled, or whether it contained non-cotton fibers. In performing my analysis I took a sample of yarns from the shirt, cut them to obtain a cross-section, prepared them for SEM evaluation, and had photomicrographs taken at very high magnification using a scanning electron microscope.

11. I analyzed the SEM images of cross-sections of the fibers taken from the Subject Shirt to determine the fabric content of the shirt. My analysis of these images reveals that the Subject Shirt was not 100% cotton, but contained a significant amount of nylon and a significant amount of rayon. As part of my analysis, I colored-coded the SEM images taken from the Subject Shirt: orange are rayon fibers, blue are nylon fibers, and gray (uncolored) are cotton fibers. True and correct copies of these annotated SEM images are attached as **Exhibit 11** to Plaintiffs' Evidence.

12. I have written extensively on fiber identification, including fiber identification utilizing the SEM method. Attached as **Exhibit 13** to Plaintiffs' Evidence is a true and correct copy of a microscopic depiction of rayon taken from a textbook, Practical Fiber Identification, that I authored for use by the Textile Engineering Department at Auburn University. Likewise, attached as **Exhibit 14** to Plaintiffs' Evidence is a true and correct copy of a microscopic depiction of nylon taken from the same published course material. It is readily apparent that the Subject Shirt being worn by Jesus Romero at the time he sustained his significant burn injuries was not made of

100% cotton but contained both rayon and nylon fibers in a blended yarn containing, in my opinion, no more than 90% cotton fibers.

13. Cotton is recognized as a natural fiber; nylon and rayon are both man-made fibers. As a result, each of these fibers reacts differently to a flame. In my career, I've performed a significant number of flammability tests on textile fabrics. Fiber content, fabric construction, fabric weight, and fabric finishes can all affect flammability. Fabrics of two or more fibers, known as blends, display flammability characteristics that are different from those of the individual fibers tested. Specific testing of a blended garment is the only way to ascertain the flammability of the blend utilized in that garment. In my opinion, to a reasonable degree of scientific and engineering certainty, the Subject Shirt was more dangerous than it would have been had it been a 100% cotton shirt as labeled.

14. Cotton is classified as a charring fiber, whereas nylon is a melting fiber and rayon is a shrinking fiber. 100% cotton quickly burns to ash; 100% nylon, while difficult to ignite, burns at a very high heat, melting and dripping rather than charring; 100% rayon is quick to ignite and shrinks as it burns until it turns to ash. The addition of rayon and nylon with the cotton in the blended yarn made this shirt more flammable and more dangerous because it adopted the worst fire performance characteristics of each fiber. A cotton/rayon/nylon blend like the one seen in the Subject Shirt and the two exemplars I tested would ignite quickly like cotton and rayon. The nylon in the blend would ignite and melt. The melting nylon, supported by a scaffolding of charred cotton, will continue to burn slowly at a very high heat. The rayon in the blend would draw the melting, charring fabric closer to the skin, further exacerbating the severity of injury suffered by the wearing. This melting/charring effect is observed in the images of the Subject Shirt's burnt edge fibers taken by Dr. David Xu and attached as **Exhibit 8** to Plaintiffs' Evidence.

15. Based upon my more than 60 years of work in fiber identification and analysis, along with the countless hours spent consulting with textile manufacturers and my knowledge of the yarn and textile manufacturing process, it is my opinion that the

cotton used to make the Subject Shirt was low-quality, immature cotton. It is my opinion that rayon and nylon were intentionally added as a component part of each yarn used to construct the Subject Shirt so as to strengthen the low-quality cotton yarn (and, by extension, the fabric), resulting in an overall production cost savings compared to the purchase of higher-quality cotton capable of meeting minimum strength standards.

16. In order to further test my opinion, I performed chemical testing and analyzed SEM images of cross-sections of fibers taken from two exemplar shirts of the same Ralph Lauren style as the Subject Shirt. Despite being labeled 100% cotton, the exemplar shirts I analyzed both exhibited similar fiber compositions to the Subject Shirt. As with the SEM images of the Subject Shirt, I colored-coded the SEM images taken of the exemplar shirts: orange are rayon fibers, blue are nylon fibers, and gray (uncolored) are cotton fibers. True and correct copies of these annotated SEM images are attached as **Exhibit 12** to Plaintiffs' Evidence.

17. Based on my analysis of the Subject Shirt and its exemplars, I agree with Dr. David Xu's opinion that the Subject Shirt was constructed of core-spun or belted yarns composed of an intentional blend of nylon, rayon, and cotton.

18. Generally, fabric blends are created within the individual yarns that are used to create the fabric that is then sewn together to create a wearable garment. A yarn is composed of hundreds of individual fibers, spun together to form a cylinder. Because clothing must meet certain minimum quality and wear standards (like tensile strength and burst strength) blended yarns have evolved to, in some cases, be highly engineered composite yarns intended to meet those standards at minimum cost to the producer. With material costs accounting for 45-60% of a garment's overall cost, even a small reduction in material costs can significantly increase profits.

19. Cotton is highly variable because it is a natural fiber. Depending on variety, growing conditions, handling and processing, cotton fibers will vary widely in maturity and length. Longer-staple, mature cotton is stronger than short-staple, immature cotton. Immature cotton is also less uniform, which further weakens yarn structure. The higher

quality cotton needed to meet minimum strength requirements is significantly more expensive than low-quality, immature cotton. The composite yarns described in Dr. David Xu's declaration—a strong nylon core surrounded by a low-quality cotton sheath with rayon fiber belts—are consistent with the fiber blends and yarn structure I observed in the SEM images of the Subject Shirt and its exemplars.

I declare under the penalty perjury, under the laws of the United States of America that the foregoing is true and correct. Executed this 12th day of August, 2016, at Auburn, Alabama.

David Hall, Ph.D., P.E.